International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 1, December 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Comparative Study on Analysis & Design of Skew Bridge by STAAD and ETABS Software using Finite Element Method

Patil Akshay Mukund[1], Nitesh Kushwaha[2]

[1]M.Tech. Scholar, [2]Professor,

[1,2]Department of Civil Engineering, Millennium Institute of Technology & Science, Bhopal, Maharashtra, India

ABSTRACT

Skew bridges are required to cross the drains at any angle other than normal. These can be helpful in making straight crossing or utilizing the available land where normal crossing are either impossible or not suitable. The slab bridges are uneconomical for large spans due to excessive design thickness but good for small spans due to its easy execution.

Bending Moment result comparison between both software i.e. Staad Pro & Etabs show little variation: For Span 15 m on Staad Pro & Etabs is 74.518 kn/sq.mm & 68.40kn/sq.mm respectively, For Span 17 m on Staad Pro & Etabs is 71.47 kn/sq.mm &66.70 kn/sq.mm respectively & For Span 19 m on Staad Pro & Etabs is 79.73 kn/sq.mm &71.95 kn/sq.mm respectively. At constant skew angle for varying span length the torsional bending moment gradually shift toward obtuse/acute angle. In both the software i.e. STAAD and ETAB the ETAB give more appropriate result in compare to STAAD.

How to cite this paper: Patil Akshay Mukund | Nitesh Kushwaha "Comparative Study on Analysis & Design of Skew Bridge by STAAD and ETABS Software using Finite Element Method" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-1, December 2019, pp.970-977, URL: www.ijtsrd.com/papers/ijtsrd29788.pdf

IJTSRD29788

1. INRODUCTION

Bridge is an important structure required for the transportation network. Now a day with the fast innovation in technology the conventional bridges have been replaced by the cost effective structured system. For analysis and design of these bridges the most efficient methods are available. Different methods which can be used for analysis and design are AASHTO, Finite element method, Grillage and Finite strip method.

OBJECTIVES

- Study of Skew Bridge with different length under Loading Condition.

METHODOLOGY

Skew bridges are required to cross the drains at any angle other than normal. These can be helpful in making straight crossing or utilizing the available land where normal crossing are either impossible or not suitable, depending on the length of short diagonal of skew slab being less or greater than its span measured along the traffic. Two specimens tested experimentally, i.e.

1. Skew slab with ratio of short diagonal to span less than unity.
2. Skew slab with ratio of short diagonal to span greater than unity.

ANALYSIS & RESULTS

STAAD PRO

Following steps are required in a sequence for proper completion:

Step-1 Preparation of geometry of tower in STAAD PRO

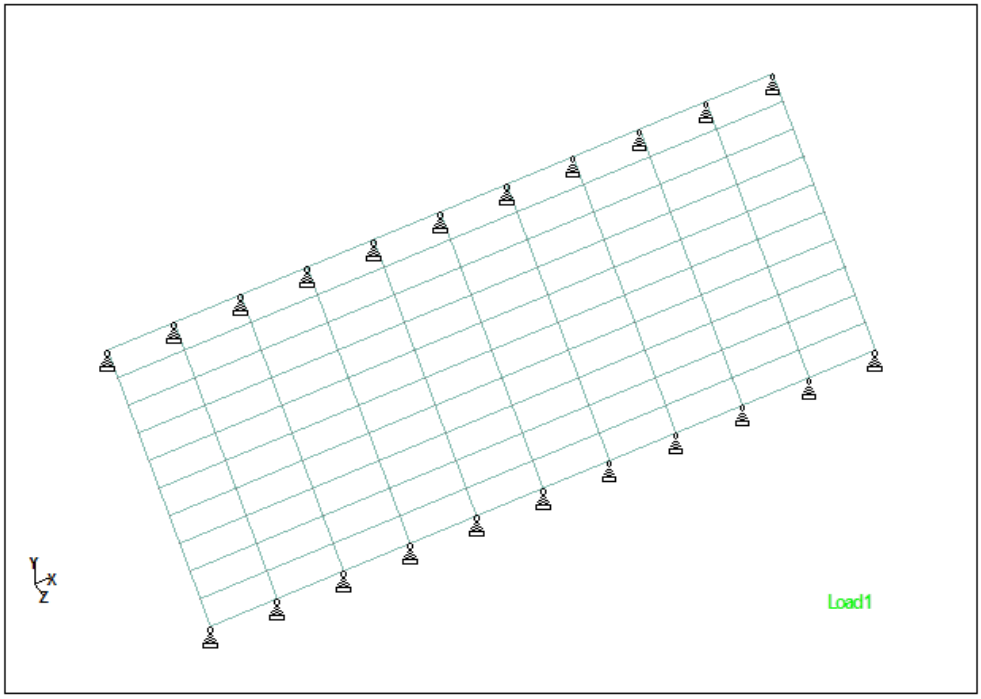


Fig 4.1 Plan view of slab with 15m span length at 15◦ skew angle

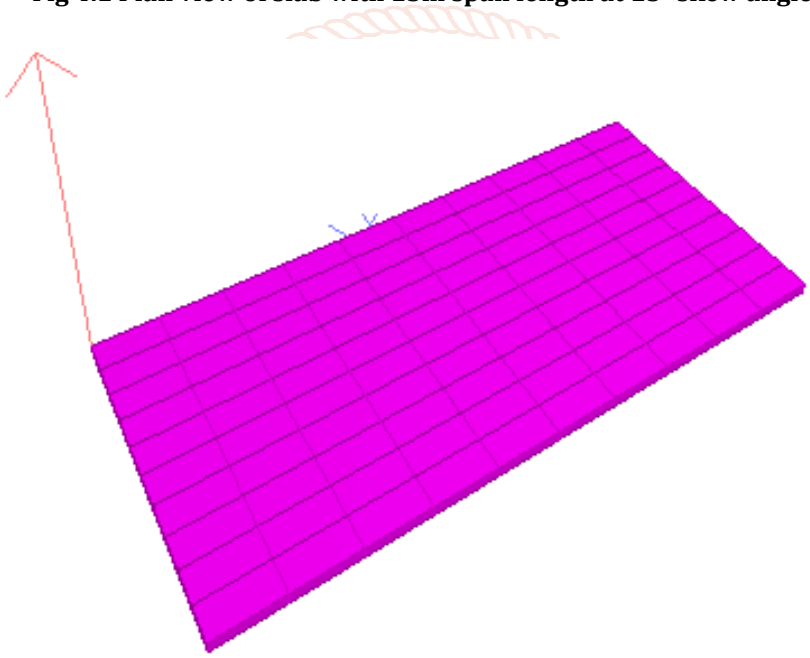


Fig 4.2 3D view of slab with 15m span length at 15◦ skew angle

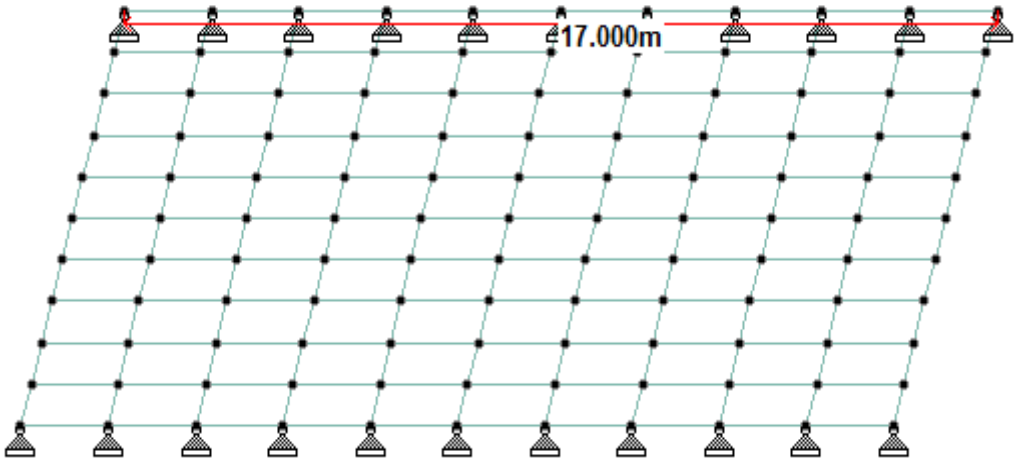


Fig 4.3 Plan view of slab with 17m span length at 15◦ skew angle

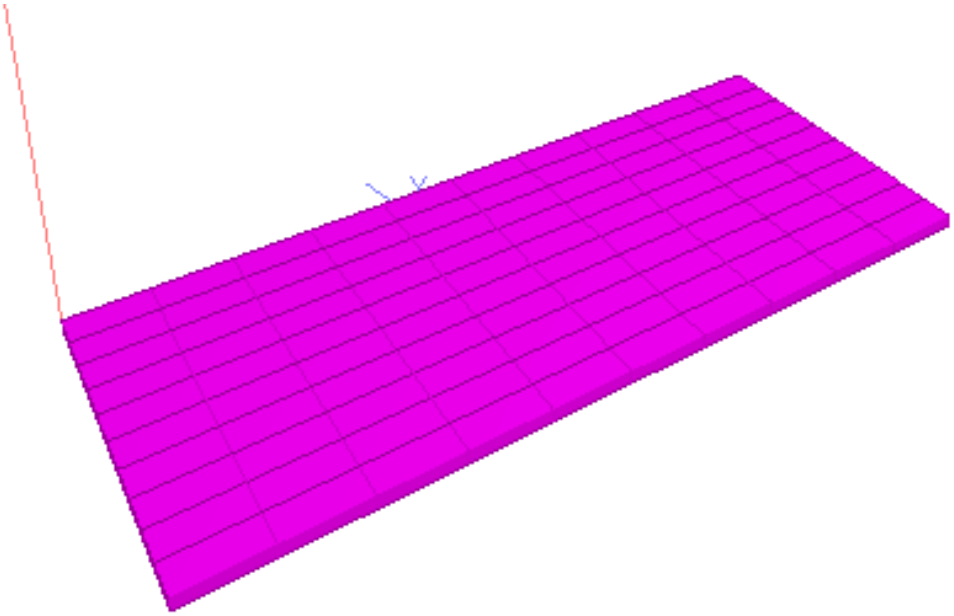


Fig 4.4 3D view of slab with 17m span length at 15◦ skew Angle

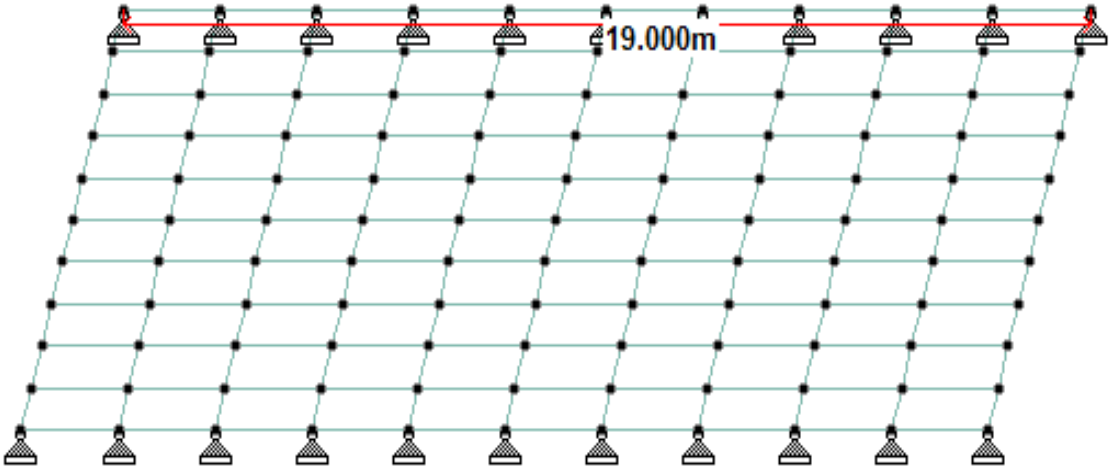


Fig 4.5 Plan view of slab with 19m span length at 15◦ skew angle

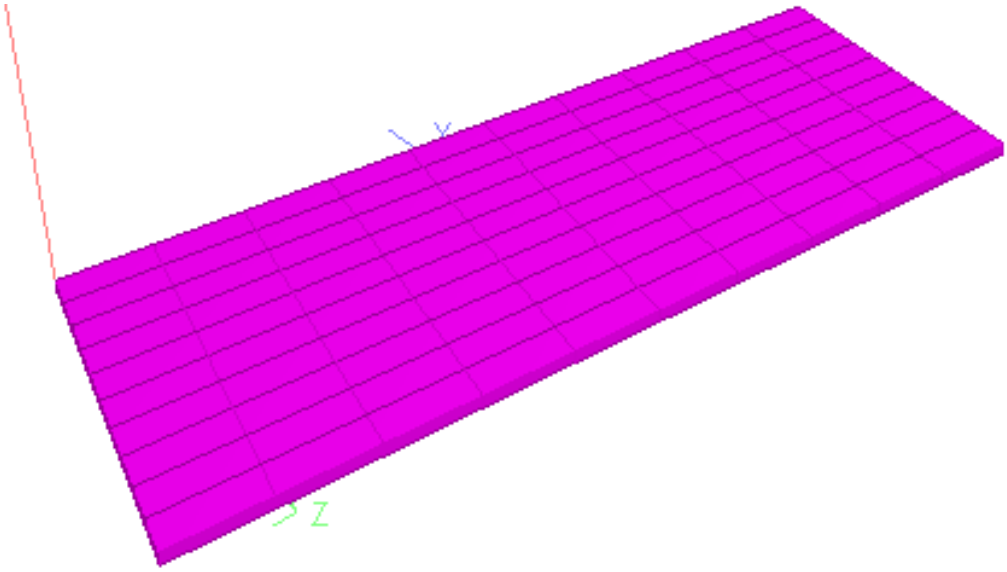


Fig 4.6 3D view of slab with 19m span length at 15◦ skew angle

Step-2 Assigning of support conditions.

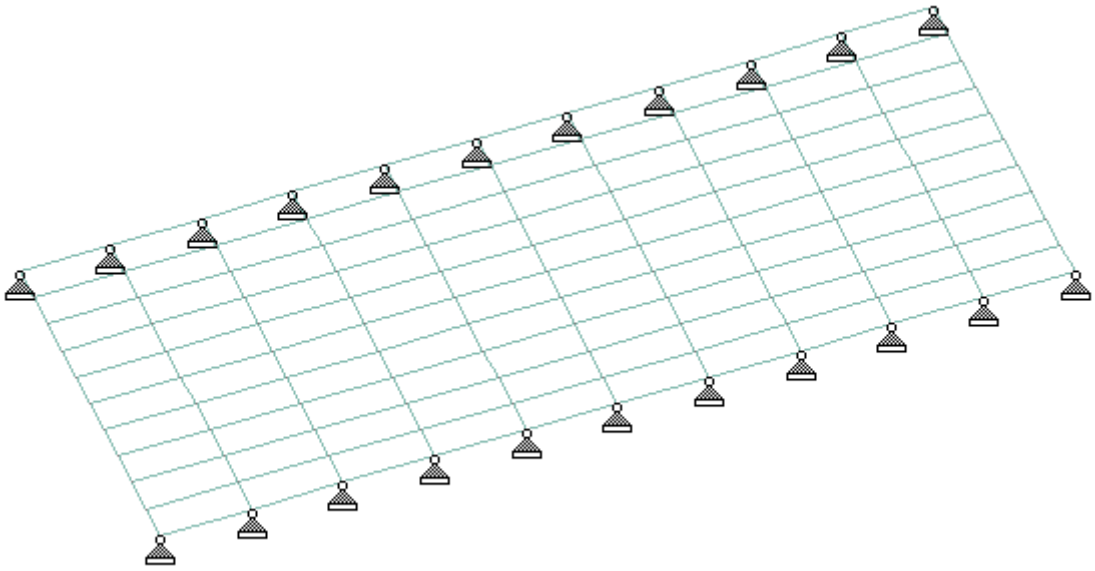


Fig 4.7 Support on slab with 15m span length at 15◦ skew angle

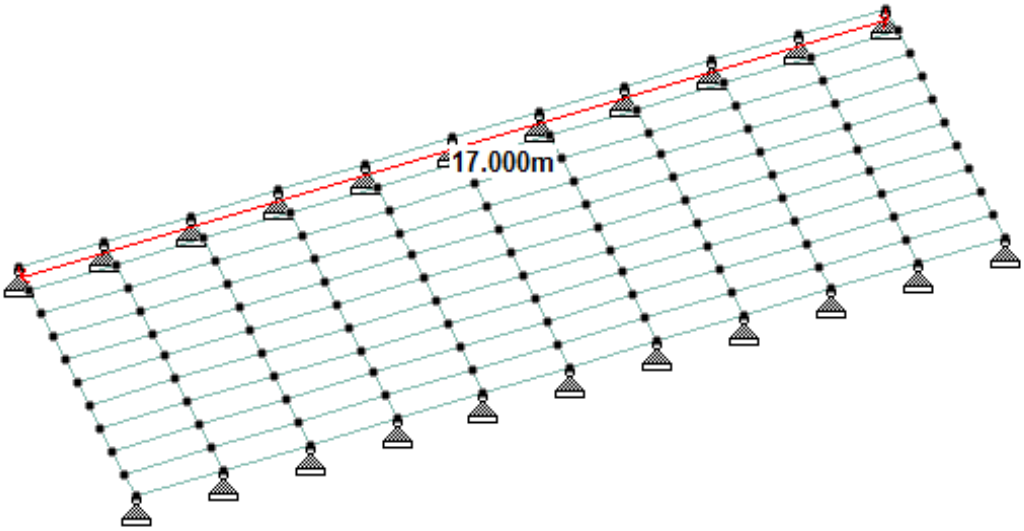


Fig 4.8 Support on slab with 17m span length at 15◦ skew angle

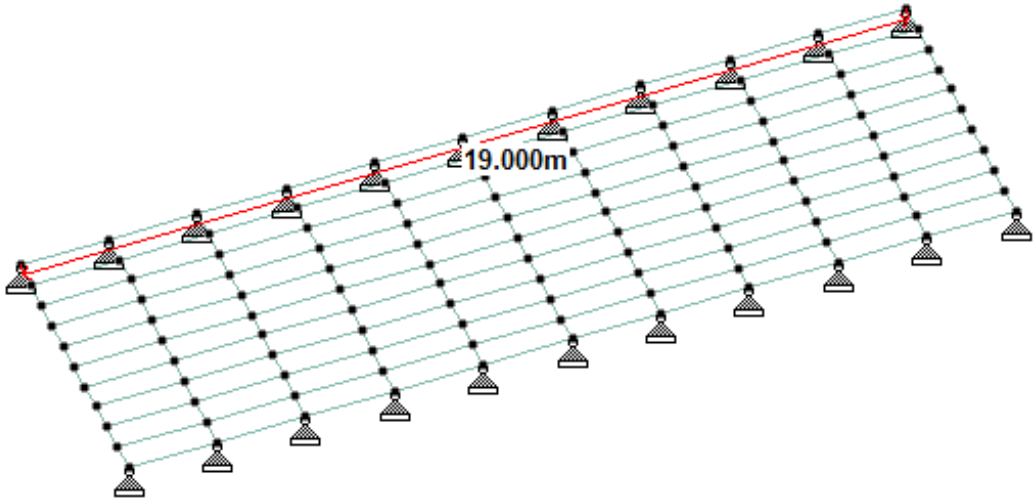


Fig 4.9 Support on slab with 19m span length at 15◦ skew angle

Step-3 Assigning vehicle load as per specification.

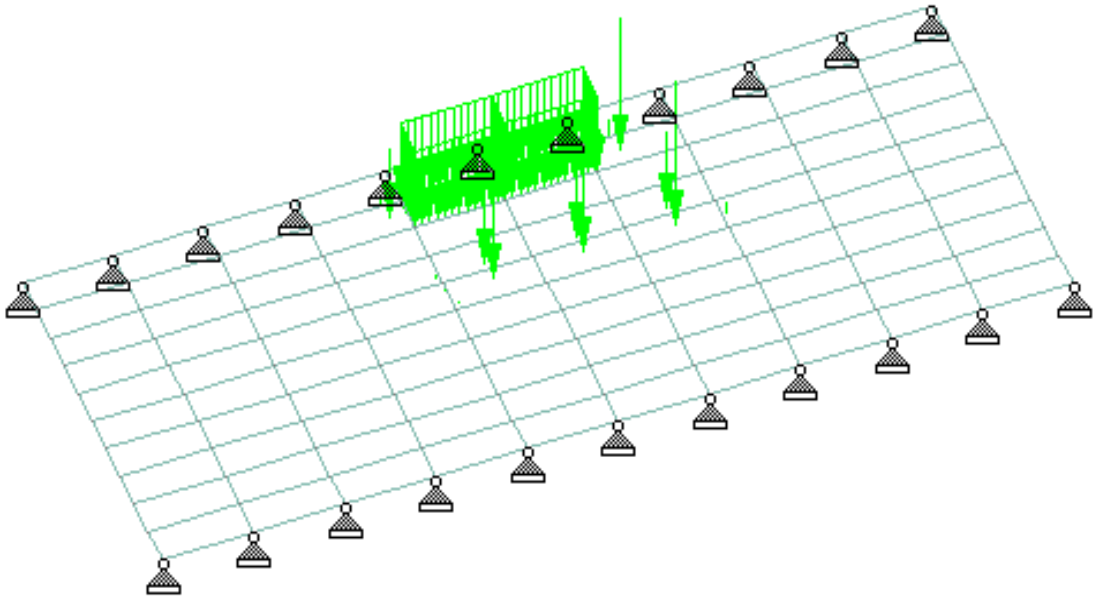


Fig 4.10 Load on slab with 15m span length at 15◦ skew angle

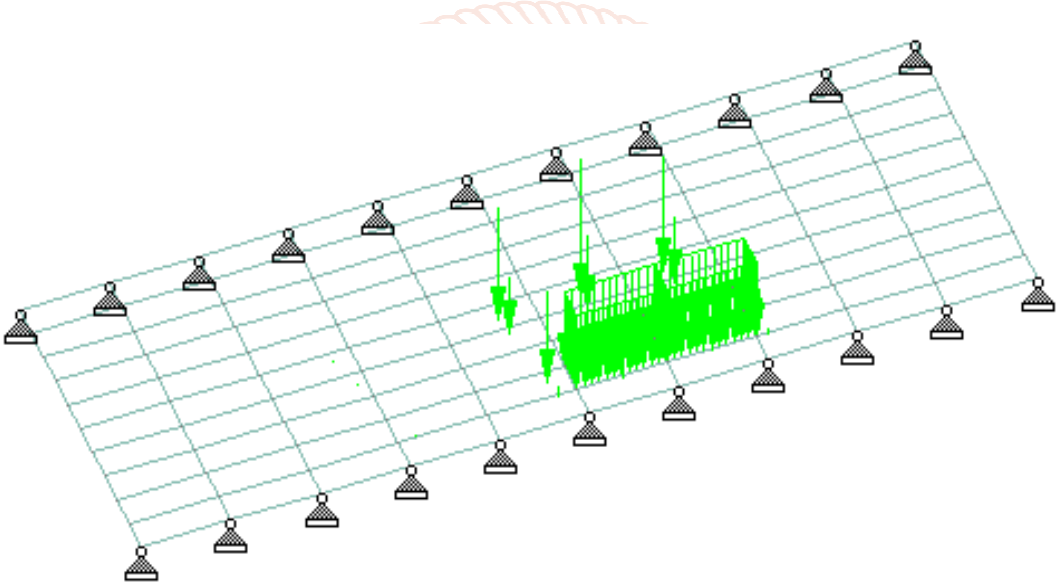


Fig 4.11 Load on slab with 17m span length at 15◦ skew angle

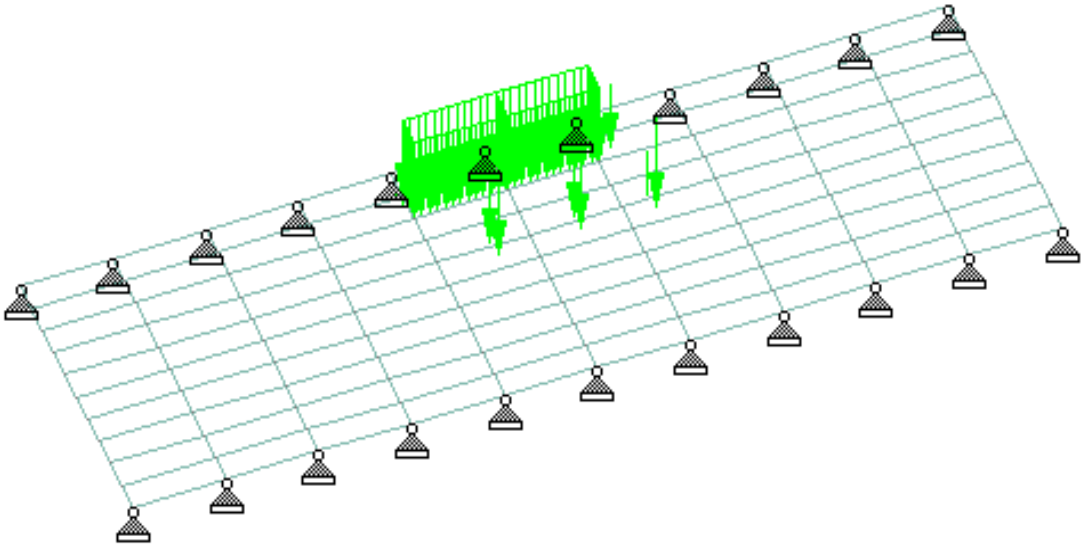


Fig 4.12 Load on slab with 19m span length at 15◦ skew angle

Step-4 Analysis

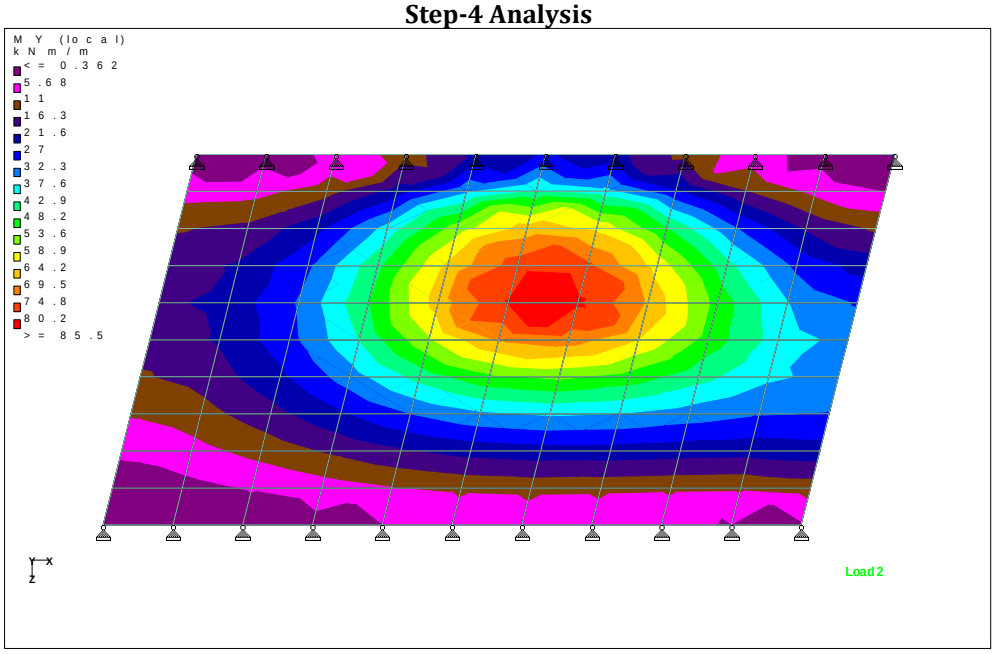


Fig 4.13 Analysis of slab with 15m span length at 15◦ skew angle

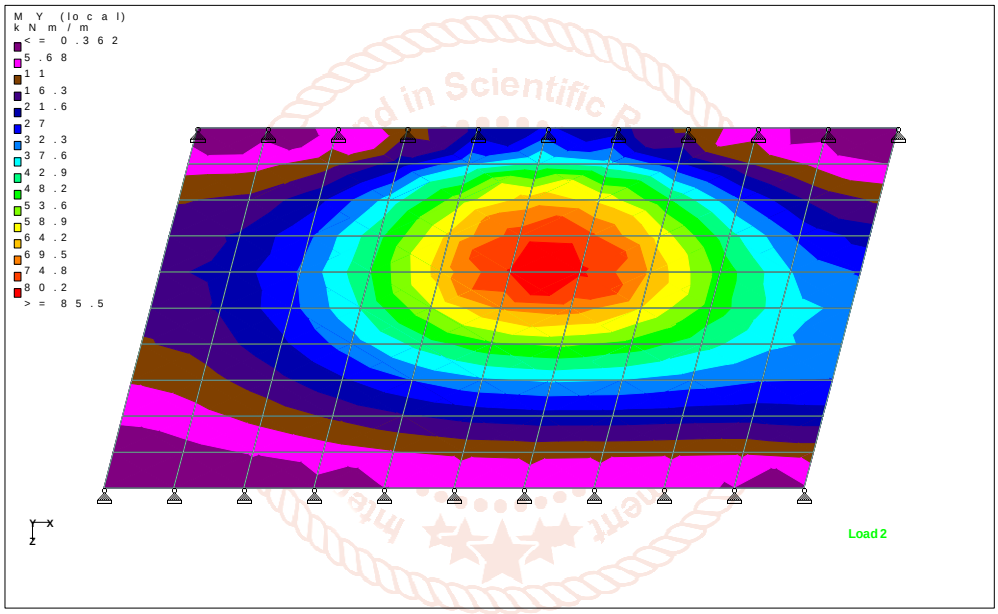


Fig 4.14 Analysis of slab with 17m span length at 15◦ skew angle

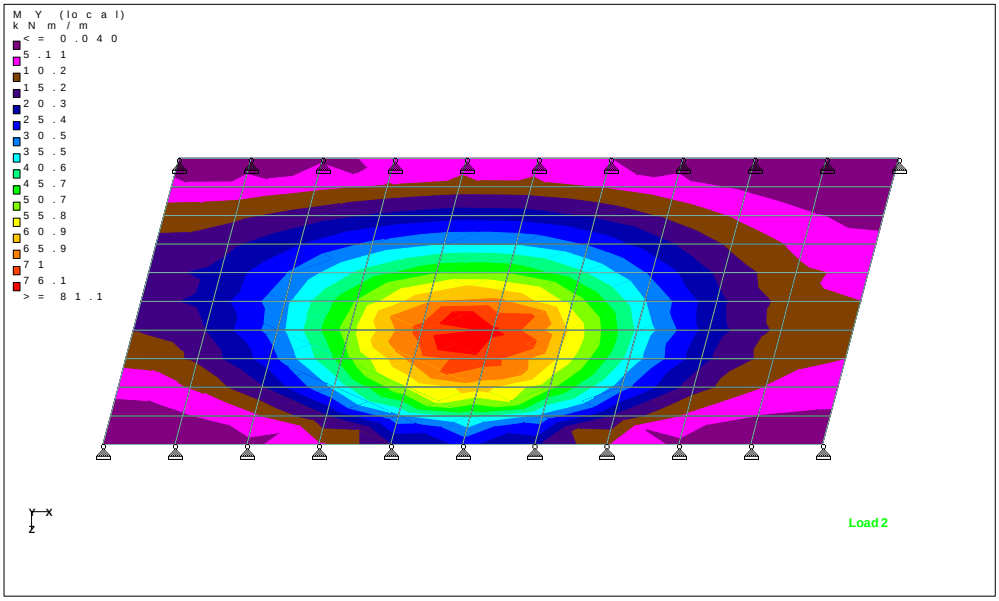
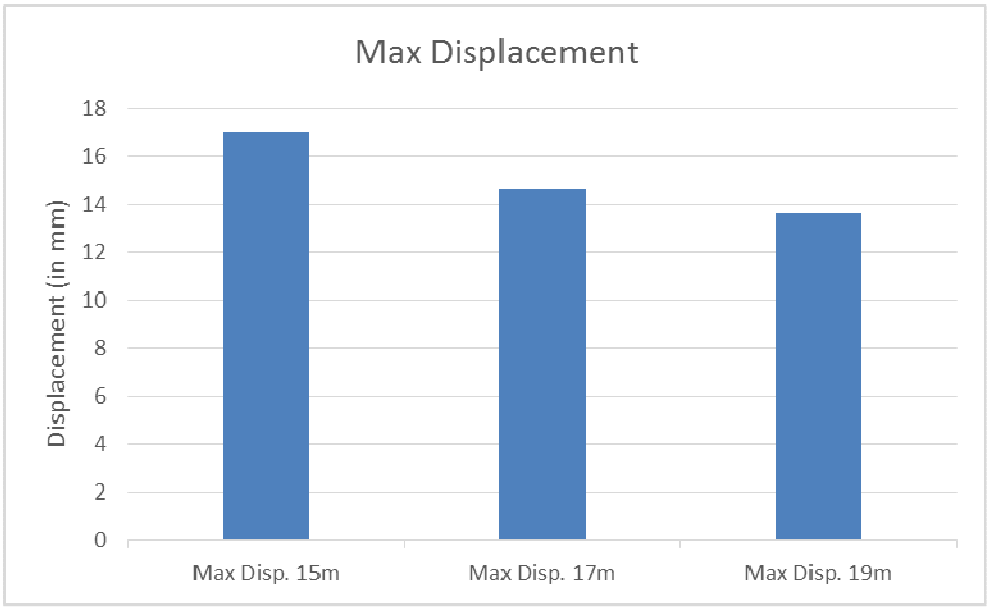


Fig 4.15 Analysis of slab with 19m span length at 15◦ skew angle

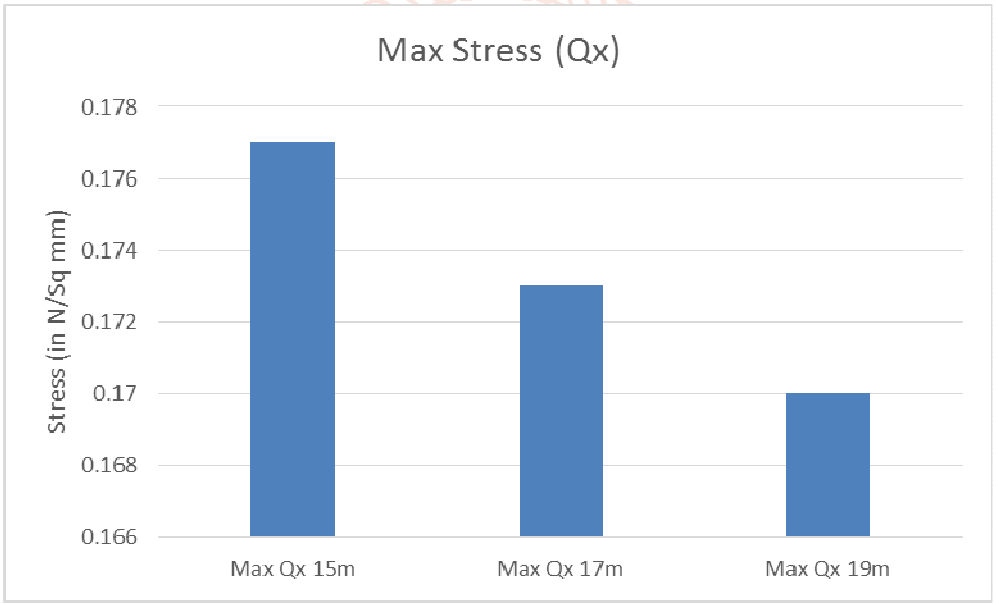
GRAPHICAL REPRESENTATION MOMENT ON BRIDGE BY BOTH SOFTWARE

GRAPH OF MAXIMUM DISPLACEMENT

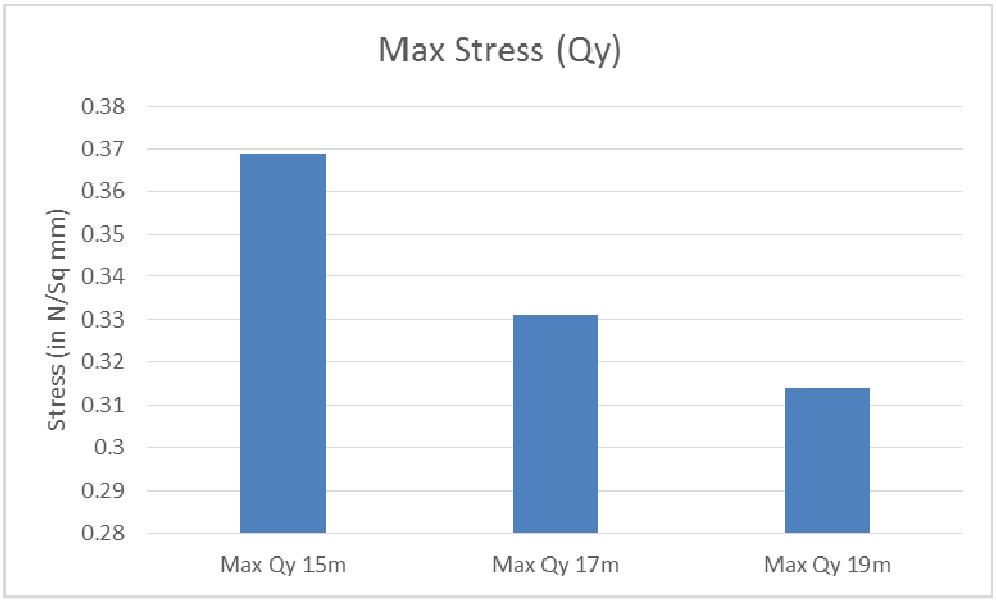


Graph 5.1 Maximum Displacement Graph

GRAPH OF MAXIMUM STRESS



Graph 5.2 Maximum Stress Qx Graph



Graph 5.3 Maximum Stress Qy Graph

CONCLUSION

The load capacity of the tilting slab increases as the tilting angle increases. Up to the angle of inclination 15° the behavior of the slanted slab is almost similar to the rectangular slab.

1. Considerable torsion of deck slab.

2. Displacement result comparison between both software i.e. Staad Pro & Etabs show very nominal variation:
   a. For Span 15 m on Staad Pro & Etabs is 17.016mm & 17.047mm respectively.
   b. For Span 17 m on Staad Pro & Etabs is 14.641mm & 14.204mm respectively.
   c. For Span 19 m on Staad Pro & Etabs is 13.638mm & 13.218mm respectively.

3. Bending Moment result comparison between both software i.e. Staad Pro & Etabs show little variation:
   a. For Span 15 m on Staad Pro & Etabs is 74.518 kn/sq.mm & 68.40 kn/sq.mm respectively.
   b. For Span 17 m on Staad Pro & Etabs is 71.47 kn/sq.mm & 66.70 kn/sq.mm respectively.
   c. For Span 19 m on Staad Pro & Etabs is 79.73 kn/sq.mm & 71.95 kn/sq.mm respectively.

4. At constant skew angle for varying span length the torsional bending moment gradually shift toward obtuse/acute angle.

REFERENCES

[1] Ajay D. Shahu, S. V. Joshi (2016)"Analysis and behaviour of skew bridges with different skew angle" Volume 3 IJCESR.

[2] Al. Mubaydeen, H.Y.H 2005 Stress Distribution at the Corner of Continuous Skew Bridges, M.Sc. Thesis, University of Jordan, Amman, Jordan.

[3] Alasa'd Intesar, 1977. Stress Distribution at the Corners of Skew Bridges, M. Sc. Thesis, University of Jordan, Amman, Jordan. PP. (1-136).

[4] Al-Foqaha'a, A. 1994. Study of Recent Loading Adopted for Bridge Design in Jordan, M. Sc. Thesis, University of Jordan, Amman, Jordan.

[5] Alfred G. Bishara, Maria Chuan Liu And Nasser

[6] Australian Bridge Design code, AUSTROADS, 1992

[7] Bridge Design using the STAAD. Pro/Beava", IEG Group, Bentley Systems, Bentley Systems Inc., March 2008.

[8] Cement & Concrete Association, Construction Industry Research and Information Association, Recommendations on the use of Grillage Analysis for Slab and Pseudo-Slab Bridge Decks, London, SW1WOAQ, 1973.

[9] Computer & Structures, Inc., SAP90 (Finite Element Analysis Users Manual), Berkeley, California. 94704 USA, 1989. PP.300.

[10] Corley, W. G. Huang, T. and Jurkovich, W.J. 1973. Preliminary Design and Proportioning of Reinforced Concrete Bridge Structures. ACI Journal. 70 (5): 328-336.